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AREA COMPLETION PROJECTS

August 1, 2023

Mr. Brian T. Hennessey, SRS Remedial Project Manager
Remediation and Deactivation & Decommissioning Division
U. S. Department of Energy
Savannah River Operations Office
Post Office Box A
Aiken, South Carolina 29802

Re: 2023 Groundwater Monitoring Report for the D-Area Groundwater Operable Unit (U) – 2021-2022 Data, SEMS Number: 63 (SRNS-RP-2023-00261, Revision 0, March 2023) received April 4, 2023.

Dear Mr. Hennessey:

The Department has completed its review of the above referenced document pursuant to the Savannah River Site Federal Facility Agreement. The attached comments were generated as a result of this review. These comments must be addressed prior to final approval of the above referenced document. As specified in Section XXII, Review/Comment on Documents, the appropriate technical staff will be available to participate in a joint DOE/EPA/DHEC comment resolution meeting to discuss these comments, if necessary.

To schedule a meeting to resolve the attached comments or to obtain further information, please contact me at (803) 898-4331.

Sincerely,

Susan B. Fulmer Digitally signed by Susan B. Fulmer
Date: 2023.08.01 14:23:15 -04'00'

Susan B. Fulmer, P.G., Manager
Federal Remediation Section
Division of Site Assessment, Remediation, Revitalization
Bureau of Land and Waste Management

cc: C. L. Bergren, SRNS-ACP (Signed Original)
Avery Hammett, DOE-SR
Travis Fuss, Aiken Environmental Affairs Office (via email)
Jon Richards, EPA Region IV
Heather Cathcart, BLWM

South Carolina Department of Health and Environmental Control Comments on:
2023 Groundwater Monitoring Report for the D-Area Groundwater Operable Unit (U) – 2021-2022 Data, SEMS Number: 63 (SRNS-RP-2023-00261, Revision 0, March 2023) received April 4, 2023.

General Comments

1. The geology and hydrogeology descriptions of D-Area and the relevant sections should be revised. Please refer to the June 2022 EMR for MNA at the CMP Pits (SRNS-RP-2022-00342), Sections 1.2 through 1.4, for an example of information that should ideally be included. The following specific comments are offered regarding these sections of the D-Area report:

    a. There is no discussion of hydrostratigraphy within the UTRA. Figure D-4 divides the UTRA into an Upper Zone (UAZ) and Lower Zone (LAZ), divided by the Tan Clay Confining Zone (TCCZ). The TCCZ can generally be seen in the cross sections in Figures D-5 through D-7, although it appears to be discontinuous and varies in depth across D-Area. However, there is no discussion in the report of different aquifer zones within the UTRA, despite this being significant to the conceptual model for D-Area.

    b. When describing hydraulic conductivity values in Section 4.1.2, the details of previous testing should be described or a document should be referenced to identify which wells the data came from.

    c. Section 4.1.2 describes a large range of hydraulic conductivity values for the UTRA (0.287 to 144 ft/day) and uses an average value of 8.5 ft/day to calculate groundwater flow rate. If the lower hydraulic conductivities within this range were gathered from wells screened in the TCCZ, a value of 8.5 ft/day may be inaccurate as it doesn't account for preferential flow through the more permeable sands in the UAZ and LAZ of the UTRA. Separate flow rates should be calculated for wells screened in the UAZ and LAZ, and hydraulic conductivity measured from wells screened within the TCCZ should be ignored for the purposes of calculating groundwater flow rate.

    d. There is little discussion of the hydraulic characteristics of the Quaternary Savannah River sediments where several downgradient wells are located. Section 4.1.2 states that these materials have a similar range of hydraulic conductivity as the rest of the UTRA but does not discuss whether this is inferred or based on previous testing. Please describe whether hydraulic conductivity has been measured in the fluvial sands near the Savannah River and discuss how the hydrology of this part of the UTRA differs from upgradient areas.

    e. Horizontal and vertical gradients should be evaluated within the UAZ and LAZ separately, and vertical gradient between the UAZ and LAZ should be calculated to understand vertical migration within the UTRA, especially in areas where the TCCZ is thin or absent. There are significant head differences between some "C" wells and shallower wells that are not discussed in the report: DCB 65A = 100.79 ft amsl, DCB 65C = 94.02 ft amsl; DCB 8 = 131.2 ft amsl, DCB 8C = 121.21 ft amsl.

f. For any horizontal or vertical gradients that are calculated, the report should clearly state which wells were used to determine the gradient. For example, page 19 states, "The horizontal hydraulic head [*sic*] of the UTRA is approximately 0.0075." Instead, please state which wells were used to calculate the gradient (e.g., "Horizontal hydraulic gradient was measured between DCB 63 and DCB 45 and was estimated to be 0.0075." The same approach should be used for reporting vertical gradients.

g. Cross sections in Appendix D should be revised to differentiate between clay layers that are considered part of the TCCZ and layers associated with the Gordon Confining Unit (GCU). The GCU is defined as the Green Clay Confining Zone (GCCZ) in other documents, and color differences noted in the boring logs for D-Area wells may aid in determining the approximate boundaries of the TCCZ and the GCU.

2. Monitoring wells in the UTRA are screened at a variety of depths and with different lengths of screen, but the purpose of wells denoted with an A, B, or C is unclear and not discussed in the report. There appears to be little consistency with the way wells are assigned letters in regard to the hydrostratigraphic units where wells are screened. For example, see Figure D-6, Cross-Section B-B'. DCB 40A is screened primarily in a clay to silty clay, approximately 63-73 ft amsl. Conversely, DCB 37A and DCB 43A are both screened in a sand to silty sand. DCB 37A is screened approximately 101-111 ft amsl, and construction details for DCB 43A are unavailable but appear to be similar to DCB 37A. DCB 43C is screened in a clay to silty clay, approximately 85-95 ft amsl. DCB 37C is screened in a sand to silty sand, 82-92 ft amsl. DCB 23B and 23C only have 2.5-ft long screens (94.1-96.6 ft amsl and 88.1-90.6 ft amsl, respectively), but together are screened at a similar depth and aquifer material as DCB 36C (87.3-97.3 ft amsl, sand to silty sand). DCB 084C is screened in sand to silty sand, with the bottom of the screen set at the top of the Gordon Confining Unit.

3. Many of the UTRA wells have screened intervals that appear to be redundant or unhelpful for delineating the extent of the plumes within the UTRA. Please discuss the purpose of some of these wells. Specific examples are listed below.

   a. DWP 6 and DWP 006A are downgradient wells located in the wetlands. The screens of both wells appear to be set in a fluvial sand to silty sand according to Figure D-7. DWP 6 has a screened interval from 91.67 ft amsl to 89.17 ft amsl, and DWP 006A is screened from 87.1 ft amsl to 82.1 ft amsl. DWP 006A is screened at the top of a fluvial clay layer, which is likely more useful than DWP 6 for delineating the VOC plume.

b. In EPA's comments on the 2020 D-Area Groundwater Monitoring Report, EPA suggested installing a well to the northwest of DCB 55 to bound the downgradient extent of the plumes. A request for approval of the additional well (DCB 090C) was submitted to DHEC in December 2022, and a screened interval of approximately 43-53 ft bgs was specified in the request. DCB-55 is screened at approximately 24-34 ft bgs. What is the reasoning behind the different screened intervals of the two wells? Are they screened in similar units or the same aquifer zone of the UTRA? Please explain.

c. DRW 001 has approximately 30 feet of screen, with the top of screen set near the middle of the TCCZ and the bottom of the screen set near the top of a clay layer (possibly the GCU). This is a large screened interval for a well, and the well is screened across multiple formations. It is unclear which aquifer zone or depth interval this well is supposed to be monitoring.

4. The lateral and vertical extents of the VOC plume are undefined. With the exception of wells installed near the source area, the highest TCE concentrations in the UTRA occur in the deeper "C" wells, specifically those with a screened interval near the top of the GCU. This is consistent with the tendency for chlorinated VOC plumes to migrate downward until "resting" on a lower permeability layer. This is also seen in the VOC soil sampling results in Appendix G, where higher VOC detections were measured near the top of the GCU or other low-permeability layers. There are no wells in the source area with a screened interval set near the top of the GCU. DCB 54 is located nearly a mile downgradient from the source area with a screened interval near the top of the GCU. The TCE concentration at DCB 54 was 28.5 ppb in 2Q2022, and there are no wells downgradient of DCB 54 with a similar screened interval. Further evaluation of the VOC plume within the UTRA and its different aquifer zones is needed to complete plume delineation.

5. The beryllium plume in the UTRA is laterally and vertically undefined. Many sampling locations were non-detect for beryllium, but the EQL was reported as 5 ppb, which exceeds the MCL of 4 ppb. The lateral extent of the plume cannot be defined without sampling results that demonstrate beryllium concentrations are below the MCL. Figure D-12 also includes arrows next to some non-detect wells indicating whether the beryllium plume is expected above or below the well screen.

6. The aluminum plume in the UTRA is undefined. DWP 006A had a J value of 2290 ppb for aluminum, which was considered not decision level data. This does appear to indicate that the aluminum plume extends further downgradient into the wetlands. There was also a detection above the NSDWS of 341 ppb at DCB 030C, with no downgradient wells to define the downgradient edge of the plume.

7. The figures in Appendix D indicate an area of dead/stressed vegetation to the northwest of the 488-D Ash Basin, but this area is not discussed in the report text. Please provide more information on this area, discuss whether it is significant to the operational history of D-Area, and whether the stressed vegetation was potentially caused by elevated contaminant concentrations or prior operations in this area.

8. Multiple sections of the report text refer to previous groundwater fate and transport modeling, but a document is not cited in the text. The "References" section cites a 2002 groundwater modeling report for D-Area. If this is what is being referred to when groundwater modeling is discussed, include an in-text citation that refers to the 2002 modeling report.

Specific Comments

1. Section 1.2, Unit History/Description, page 2. The last sentence of this page references Figure D-17 after discussing the connections between D-Area Effluent Discharge Canal, Beaver Dam Creek, and Savannah River. Figure D-2 would perhaps be a more adequate reference instead to show these connections.

2. Section 1.2, Unit History/Description, page 2. The last sentence describes groundwater discharge to surface water and its eventual discharge to the Savannah River, but the section does not discuss the $CaCO_3$ reactive structures installed in the D-Area Effluent Discharge Canal in 2020. The reactive structures were installed to raise surface water pH as part of the treatability study for D-Area Groundwater. Please revise this section to include some discussion of the reactive structures.

3. Section 1.2, Unit History/Description, page 4. The last paragraph discusses soil vapor extraction (SVE) wells in the 711-D area but does not provide much detail. When did the SVE system start up? Is it still running or was it shut down in response to diminished VOC concentrations in the vapor? Are the VOCs chlorinated solvents or petroleum/BTEX constituents (given that this area is adjacent to the 715-D Gas Station Area)? Please reference some relevant documents to the SVE system and previous work in this area.

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4. Section 2.0, Monitoring Network, page 8. The second sentence of this section states there are 107 wells associated with the DAG OU, and the next sentence references Appendix A. Appendix A lists 105 wells; furthermore, the compliance monitoring tables in Appendix C list the same 105 wells with the inclusion of an additional 5 auxiliary wells. Table B-1 lists exactly 107 wells. Please verify if the total number of wells listed here for the DAG OU network is accurate and revise the document to reference a table that contains the complete DAG OU monitoring network (provide a new table if necessary). Please see Specific Comments 17 and 20 for further details.

5. Section 2.0, Monitoring Network, page 8. A new monitoring well, DCB090C, is mentioned in the first paragraph of this section. Please include its location in Figure D-3 or a separate figure if necessary.

6. Section 3.0, Monitoring Results, page 9. Table B-2 is referenced in the first sentence for monitoring well sample stations, frequencies, and analytes. Table B-1 should be referenced instead.

7. Section 3.2, Volatile Organic Compound Plume, page 13. The last complete sentence on page 13 states: "One GA well, DRW001D had a TCE concentration of 23.2 µg/L above the MCL". Please rephrase this sentence or include a comma between "23.2 µg/L" and "above", as this could be misinterpreted to mean a concentration that is 23.2 µg/L higher than the MCL.

8. Section 4.1.2, Horizontal Gradient Flow Rate and Direction, page 19. This section states, "The horizontal hydraulic head of the UTRA is approximately 0.0075." The reported value appears to be horizontal hydraulic gradient, not hydraulic head. Please correct this and add a similar statement regarding the GA: "The estimated hydraulic head of the GA is approximately 0.0091."

9. Section 4.1.3, Vertical Gradient Flow and Direction, page 19. This section states, "The total range of the vertical groundwater flow gradient is a 2.12 m (7.26 ft) downward gradient and a -1.44 m (-4.73 ft) upward gradient." Vertical hydraulic gradients are typically less than an absolute value of one and are expressed either as a unitless number or in units of ft/ft. Please explain what these values represent and how they were calculated.

10. Section 4.1.3, Vertical Gradient Flow and Direction, page 19. The section reports the head difference between the UTRA and GA as "approximately 1.5 (0.5 ft)." The number 1.5 is missing a unit in the report, but assuming this is meant to follow typical formatting in SRS documents with the value in meters followed by the value in feet, one of these numbers does not make sense. 1.5 meters would convert to 4.9 feet, and 0.5 feet converts to 0.15 meters. Please correct.

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11. Section 4.1.3, Vertical Gradient Flow and Direction, page 19. This section presents data regarding head differences between the UTRA and GA, then states that the data "indicat[e] the horizontal movement of groundwater is much greater than the vertical component." This is probably an accurate statement since it is comparing horizontal hydraulic gradient within an unconfined aquifer to vertical groundwater flow between confined and unconfined aquifers, but it is unclear why this is significant. Vertical movement of groundwater between the GA and UTRA is likely limited by the confining unit, and minimal vertical movement between the aquifers should be expected. Please explain.

12. Figure D-4, Lithostratigraphic and Hydrostratigraphic Units at SRS, page D-11. There are some discrepancies between the figure, the lithostratigraphy described in Section 1.5, and the SRS Geology/Hydrogeology Environmental Informational Document (WRSC-TR-95-0046). Section 1.5 and the SRS Geology Document discuss the Clinchfield Formation, which is not shown in the lithostratigraphic column in Figure D-4. Please correct.

13. Figure D-8, Potentiometric Surface of the Upper Three Runs Aquifer, 2Q2022, page D-19. The figure has multiple apparent errors. Please revise the figure to address the comments below.

    a. The groundwater elevation shown on the figure for DCB 23A (110.18 ft amsl) does not match either of the 2Q2022 measurements for this well in Table C-3 (109.69 ft amsl on 5/25/22; 111.53 ft amsl on 4/13/22).

    b. The figure includes a measurement for DCB088A collected in 4Q2022, while all other measurements were collected in 2Q2022. Measurements made in 4Q2022 should not be included in a potentiometric surface map for 2Q2022 because of seasonal variability in groundwater elevation.

    c. The contours in this figure appear to have been drawn based primarily on wells located in the upper portion of the UTRA but does not address the significant difference in potentiometric surface observed at some "C" wells. For example: DCB 65A = 100.79 ft amsl, DCB 65C = 94.02 ft amsl; DCB 8 = 131.2 ft amsl, DCB 8C = 121.21 ft amsl. The difference in head between A wells and C wells at these locations is not addressed elsewhere in the report and should be evaluated further.

    d. A significant number of the measurements used in the figure were collected on 5/12/22, while some were collected on different days, up to a month later (e.g., DCB 030C, 6/2/22; DWP 006A, 6/7/22; DCB 085A, 5/25/22). Because of the extensive well network at D-Area, it may not be possible to collect all measurements within the same day or two. However, measurements collected several weeks or a month later should be clearly marked on the figure and considered possibly unreliable when drawing contours. Additionally, efforts should be made in future sampling events to measure pairs or clusters of wells with different screened intervals on or close to the same day. For example, DWP 6 and DWP 006A were measured nearly a month apart, and a reliable vertical gradient between the two wells cannot be calculated.

e. Please explain why the 90-ft contour near DWP 6 and DWP 006A is inferred. As discussed in other comments, the measurement for DWP 006A should be considered unreliable for drawing potentiometric surface contours because it was measured nearly a month later than most other wells, including DWP 6.

14. Figure D-12, Beryllium Concentrations in the Upper Three Runs Aquifer. The figure includes arrows next to some well locations indicating whether the beryllium plume is expected above or below the well screen. If the plume is expected at a different depth at these locations, additional wells should be installed to delineate the vertical extent of the plume. Please describe the reasoning used to determine the expected depth of the plume at these locations and describe any plans to further delineate the beryllium plume.

15. Figure D-12, Beryllium Concentrations in the Upper Three Runs Aquifer. Multiple monitoring wells and surface water stations do not have symbols marking their locations. Please revise the figure appropriately.

16. Table A-1, Well Construction Summary, page A-3. The wells in this table are labeled as either piezometers or monitoring wells, but there are inconsistencies regarding how wells are labeled in Table A-1, Table B-1, and Tables C-1 through C-4. Some wells in Tables C-1 through C-4 are labeled auxiliary, but there are no auxiliary wells listed in the other tables. Please revise the tables as needed.

17. Table A-1, Well Construction Summary, pages A-3 through A-6. The following inconsistencies and/or errors should be addressed:

    a. This table lists construction details for a total of 105 monitoring wells. Section 2.0 states there are 107 wells associated with the DAG OU.

    b. The following wells are not included in this table but appear in other tables and elsewhere throughout the document: DAP2, DCB 20A, DCB 20B, DCB 20C, DCB 20D, DCB 41A, DCB 41C, DCB 43A, DCB 43C, DCB 64, DUT 001, DUT

002 and DUT 003. Please review the table and revise to ensure that construction details are available for all wells in the monitoring network.

c. Well Types for several wells (monitoring/piezometer) are different than the ones listed for these same wells in Table B-1.

18. Table A-1, Well Construction Summary, page A-3. Please add columns for top of screen in ft bgs, bottom of screen in ft bgs, and top of casing elevation in ft amsl.

19. Table A-1, Well Construction Summary, page A-3. As discussed in previous comments, the different aquifer zones of the UTRA should be described in more detail, and UTRA wells should be categorized based on the aquifer zone where their screens are set. Add a column to the table identifying which aquifer zone the UTRA wells are used to monitor.

20. Table B-1, Groundwater Samples Analyte List and Sample Frequency, pages B-3 through B-6. The following inconsistencies and/or errors should be addressed:

    a. This table lists exactly 107 monitoring wells, which matches the number of wells in the DAG OU monitoring network stated in Section 2.0. If these are the same wells mentioned, please revise the title of this table to indicate that these are the DAG OU monitoring network wells.

    b. Well Types for several wells (monitoring/piezometer) are different than the ones listed for these same wells in Table A-1.

    c. Monitoring well DCB 33D is listed as a UTRA aquifer well. It should be changed to a GA aquifer instead.

21. Table B-1, Groundwater Samples Analyte List and Sample Frequency, page B-3. It is unclear why some wells are labeled as monitoring, piezometer, or auxiliary (Appendix C tables). Piezometer usually implies a well that is primarily used for water level measurements, but multiple piezometers in Table B-1 are sampled for analytical parameters (e.g., DCB 21A). Conversely, some monitoring wells are specified only for water level measurements (e.g., DBP 1). Please explain the reasons for labeling a well as a monitoring well, piezometer, or auxiliary well.

22. Table B-3, Additional Sampling Locations During 2022, pages B-8 and B-9.

    a. The following wells were sampled and analyzed for PFAS in 2022 according to Table C-7 but are not included in Table B-3: DCB wells 23A, 23B, 23C, 23D, 27, 27C, 027D, 030C, 030D, 35A, 35C, 52C, 54, 59A, 61, 65A, 65C, 080, 082,

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083A, 083D, 084C, 084D, 085A, 085C, 085D, 087A, 087D, 089D (missing a PFAS designation under Additional Analyses) and DWP wells 001A, 003A, 003C and 006A. Also, surface water sampling stations DSWM-3, -5, -6, -8 and -10 should be included in Table B-3 as well.

b. Monitoring well DCB 51D is listed twice.

c. Monitoring wells DCB 45D and DWP009A list incorrect aquifer designations.

d. Monitoring wells DCB 41A and 41C appear to be wells in the DAG OU Network that were sampled during 2Q2022 according to Table C-3 but were listed as "Not Sampled".

23. Tables C-1 through C-4, Appendix C. Please revise the tables to address the following.

a. The rows for NPDWS and NSDWS appear to be switched. For example, the tables show a NSDWS of 10 ppb for arsenic, but this is the MCL (or NPDWS).

b. Some of the sampling locations in the far-left column are highlighted orange, but there is no explanation at the bottom for what this means.

c. Please explain what the Synchronous Measurement Date and Synchronous Water Elevation Columns mean in relation to Sample Collection Date and Sampling Event Water Elevation.

d. Values reported in units of feet should be more specific if they are measured in reference to a specific datum. For example, water elevation is likely measured in feet amsl, and depth to water should be measured in feet below the top of the well casing (btoc). Please make this clear in the tables.

e. Multiple locations have a synchronous water elevation measurement without an associated depth to water measurement (e.g., Table C-3, DBP 1: synchronous water elevation = 113.77, depth to water = "NS"). For rows that have both a synchronous water elevation and sampling water elevation value, it is unclear why there is only one depth to water measurement reported, and which water elevation it is associated with.

f. The aquifer zone listing for monitoring well DCB027D is incorrectly listed "UTRA" in all four tables. DCB063D is also incorrectly listed as "UTRA" in Table C-3.

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24. Table C-5, 4Q2021 D-Area PFAS Sampling Summary Table, page C-11. Station IDs PW 3D and PW 136D are listed in this table and are also shown in Figures D-33 and D-34 as groundwater sampling stations for PFAS sampling in 4Q2021. These sampling stations are not mentioned or listed anywhere throughout the document. Please provide some information regarding these stations and include them in any other applicable tables in Appendices A and B.

25. Appendix G, Section G 3.0, VOC Soil Sampling at the Bubble Tower Area Wells, page G-5. The second paragraph states the following: "Please note VOC results below the detection limit are treated as 0 parts per million vapor (ppmv) to focus on the soil horizons containing PFAS compounds." Please explain the meaning behind the second part of the sentence regarding PFAS. How are PFAS relevant in this context?

26. Appendix G, Section G 3.0, VOC Soil Sampling at the Bubble Tower Area Wells, page G-5. The second paragraph states the following: "Please note VOC results below the detection limit are treated as 0 parts per million vapor (ppmv)." Please discuss the range of detection limits seen with this method, as the reported detections in Appendix G appear to be relatively low.

27. Appendix G, Section G 3.0, VOC Soil Sampling at the Bubble Tower Area Wells, page G-5. This section reports the VOC soil sampling results but does not discuss whether any of the detections were significant in regard to further delineating the VOC groundwater plume. The highest detection reported was 4.47 ppmv TCE in boring DCB 088 from a sample collected near the top of the GCU (Figure G-8), but there is no discussion of installing a well in this area. These results demonstrate the chlorinated VOC plume generally migrating downward until contacting the less permeable GCU, and further demonstrate that the vertical extent of the plume has not been captured by most of the wells installed in the upper portion of the UTRA.

28. Figure G-2, DAG OU PFAS Plume (2Q2020), page G-9. This figure uses data from 2020 and should be updated with the most recent data collected in 2022.

29. Figure G-3, DAG OU VOC Plume (2Q2020), page G-11. This figure uses data from 2020 and should be updated with the most recent data collected in 2022.

30. Table G-1, DAG OU Monitoring Wells and Soil Borings, page G-19. Please revise the table per the comments below.

    a. The columns with screen zone should indicate whether these values are in ft amsl or ft bgs.

b. The ground elevation column should include the unit for ft amsl if that is the unit being referred to.

c. Borings should not include values for top of screen and bottom of screen.